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The present study examined the utility of testing noncognitive aptitudes as a predictor of graduation from US Air Force air traffic controller training. A total of 1,003 training candidates participated in the study. Results of logistic regression indicate that noncognitive areas of functioning at the start of training significantly predicted graduation. Higher levels of emotional self-awareness, self-actualization, reality testing, stress tolerance, happiness, and approach to problem solving best differentiated graduates from nongraduates. The results of the study suggest such areas of functioning are important for training success.

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The Utility of Testing Noncognitive Aptitudes as Additional Predictors of Graduation From US Air Force Air Traffic Controller Training

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Original Article

Abstract. The present study examined the utility of testing noncognitive aptitudes as a predictor of graduation from US Air Force air traffic controller (ATC) training. A total of 1,003 training candidates participated in the study. Results of logistic regression indicate that noncognitive areas of functioning at the start of training significantly predicted graduation beyond the effects of a measure of cognitive aptitude. Higher levels of emotional self-awareness, self-actualization, reality testing, stress tolerance, happiness, and approach to problem solving best differentiated graduates from nongraduates. The results of the study suggest such areas of functioning are important for training success.

Keywords: noncognitive testing, air traffic control, training

US Air Force (USAF) air traffic controllers (ATCs) are a unique group of military personnel in a high-risk, high-demand career field responsible for monitoring and directing air traffic by utilizing radar, non-radar capabilities, and various computer-based technologies (USAF, 2006, 2013a). They must sustain vigilance, prioritize, analyze, and respond to a wide array of visual and auditory information in an environment where information is constantly changing. This includes evaluating altitude, speed, distance, and direction of multiple aircraft while assessing factors such as weather conditions across time zones, varying aircraft arrival and take-off times, and other operational issues to ensure safe and effective management of flight operations. The career field is known for a high operational tempo where threats to human safety and the consequences of mistakes are substantial. The day-to-day operational tasks of air traffic control can present many unpredictable and uncontrollable events in which the effective management of air traffic relies heavily upon the controller's skills gained from training and experience, as well as his or her inherent psychological attributes (e.g., cognitive aptitude, stress tolerance, self-confidence, approach to problem solving, etc.).

Screening and Selection Procedures

To ensure candidates are well suited for the rigors of air traffic control, they must meet stringent aeromedical and personnel classification requirements. All training applicants must meet USAF "fitness for duty" as well as ground-based controller medical standards (USAF, 2013b). Applicants are disqualified from entering training if they have any current or past history of medical or psychiatric illness reasonably perceived, at the discretion of a physician, to impair performance. If an applicant has a history of a medical condition (e.g., bacterial meningitis, closed head injury, multiple sclerosis, optic neuritis, cardiovascular disease, uncorrected visual difficulties) or a psychiatric illness (e.g., major depression, anxiety) that may affect functioning under the austere stresses of the career field, then he or she is disqualified from entering training. This is to ensure training candidates can sustain physical and psychological health in routine and emergent conditions without elevating risks to safety while performing their duties. The medical screening standards and requirements for civilian, Federal Aviation Administration (FAA) training candidates are similar to USAF standards (Office of Personnel Management, 2014).

Furthermore, applicants are screened using the Armed Services Vocational Aptitude Battery (ASVAB; Defense Manpower Data Center [DMDC], 2008). The ASVAB is a cognitive aptitude test given to select enlisted military training applicants. At the time of this study, the ASVAB consists of four composite T scores (General, Mechanical, Electrical, and Administrative). USAF ATC training applicants must obtain a minimum ASVAB General composite

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T-score of 55 and a Mechanical Composite T score of 55 (USAF, 2006, 2013a) before being selected for training. The ASVAB General composite score is derived from the subtests of Arithmetic Reasoning and Verbal Expression (which is a combination of scores from the Paragraph Comprehension and Word Knowledge subscales). General cognitive aptitude is a well-known predictor of performance (Schmidt, 2002; Schmidt & Hunter, 1998; Schmidt & Hunter, 2004), and prior research has found ASVAB scores to be predictive of training outcomes for ATCs (Carretta & Frederick, 1999; Carretta & King, 2008; King, Manning, & Dreschler, 2006; McBride, 2012).

Brief Description of Training Pipeline

The use of the ASVAB and required cut-off scores reflects the importance of training candidates having a high level of cognitive functioning to acquire the necessary skill sets within a condensed period of time (e.g., approximately 1 year). To become fully certified, training candidates must complete two phases of training (Manacapilli et al., 2012).

The first phase is the Technical Training Course. This course teaches the fundamentals of flight, as well as international, national, and military directives that govern air operations. Candidates are taught ATC phraseology; how to utilize maps, aeronautical charts, navigational aids, and communication systems; as well as FAA rules and regulations governing the controlling of aircraft. The majority of their training focuses on controlling aircraft via radar (which covers between 50 and 80 square miles) and tower, such as the final seven square miles related to an aircraft's approach.

The second phase is Certification Training. Candidates who successfully pass technical training subsequently enter radar or control tower operations for certification training. This training occurs at their first assigned operational duty installation and is approximately 9–12 months. During certification training, candidates must learn and demonstrate the ability to control and regulate en route and terminal air traffic. They must obtain qualification in initiating and issuing clearances, instructions, and advisories to ensure the safe and expeditious flow of air traffic operating under instrument and visual flight rules. They must demonstrate skills in planning, organizing, directing, and evaluating a wide array of air traffic control activities.

The costs for selecting and training USAF ATC candidates are substantial and 90% of training failures are due to academic issues (Manacapilli et al., 2012). Although mistakes and performance errors are tolerated as training candidates develop their skill sets, those who make substantial and/or repeated errors are eliminated from training. The overall attrition rate is approximately 49% and occurs at a steady rate throughout training.

Training is a complex process influenced by a range of factors. Unforeseen life events, medical illnesses and injury, major life stressors, the motivational level of training candidates, as well as recruiting and training processes are all potential contributors to attrition. While increasing the number of recruits may increase training production rates, it is reasonable to consider a more cost-effective approach by making improvements to the screening process (Manacapilli et al., 2012).

Although current screening processes ensure candidates exemplify high levels of health and cognitive aptitude, not all healthy and highly intelligent candidates are successful with adapting to rigorous conditions. A logical step to improving screening processes is the addition of testing that assesses noncognitive functioning relevant to occupational training and tasks. There is a growing body of literature suggesting aspects of a person's noncognitive aptitudes (i.e., emotional, behavioral, and social functioning) have a significant impact on job performance (Barrick, 2005; Barrick, Mount, & Judge, 2001; Burch & Anderson, 2008; Day & Silverman, 1989; Judge & Ilies, 2002; Le et al., 2011; Mount, Barrick, & Stewart, 1998; Tett & Burnett, 2003; Tett, Jackson, Rothstein, & Reddon, 1999; Thoresen, Bradley, Bliese, & Thoresen, 2004). In particular, noncognitive aptitudes (e.g., high levels of conscientiousness and stress tolerance) have been found to distinguish civilian ATCs from the general population (Dean, Russell, & Farmer, 2002; Karson & O'Dell, 1971, 1974; King, Retzlaff, Detwiler, Schroeder, & Broach, 2003; Luuk, Luuk, & Aluoja, 2009; Nye & Collins, 1991; Schroeder, Broach, & Young, 1993). More recent studies of ATC training candidate selection results found that interviewer ratings of general motivation, career-specific motivation, and social competence were associated with subsequent training success (Conzelmann & Keye, 2014; Pecena et al., 2013). However, the aforementioned studies are limited by correlational designs and small samples, which restrict the ability to make definitive conclusions about the predictive utility of noncognitive functioning. These studies also do not assess other areas of noncognitive functioning likely relevant to performance (e.g., emotional self-awareness, independence, reality testing, and self-confidence).

The importance of noncognitive functioning has been perpetuated by theories of emotional and social intelligence (e.g., Bar-On, 2004; Goleman, 1995; Mayer, Salovey, & Caruso, 2004). Such theories focus on an array of abilities (e.g., self-regard, emotional self-awareness, independence, self-actualization, stress tolerance, flexibility, optimism, interpersonal demeanor) not currently addressed by traditional tests or theories of intelligence and cognitive functioning. One test measuring these abilities is the Emotional Quotient Inventory (EQ-i). Higher scores on the EQ-i scales are associated with better coping in stressful situations (Slaski & Cartwright, 2003) and higher levels of physical and emotional health (Day, Therrien, & Carroll, 2005). Although others have found the test to be susceptible to faking (Day & Carroll, 2008; Grubb & McDaniel, 2007), the test has positive and negative impression management scales to assess an individual's response style to test items. Although there is criticism regarding the accuracy of measuring noncognitive competencies via self-report (Cooper & Petrides, 2010), the EQ-i continues to be applied in a variety of academic and real-world settings (Lievens, Klehe, & Libbrecht, 2011) with acceptable psychometric properties, such as internal consistency, convergent validity,

and resistance to response style and bias (Dawda & Hart, 2000; Kun et al., 2012).

However, theories of emotional and social intelligence are controversial. Matthews, Zeidner, and Roberts (2002) noted such theories are often vague. Others have argued labeling noncognitive abilities as a form of intelligence is a misinterpretation of the intelligence construct (Locke, 2005). The most prominent criticism of emotional and social intelligence theories is centered on the results of studies that have found the domains and facets of such constructs to resemble (and are highly correlated with) personality traits and taxonomies (Austin, 2009; Fiori & Antonakis, 2011; Landy, 2005; Mikolajczak, Luminet, Leroy, & Roy, 2007; Newsome, Day, & Catano, 2000; Petrides & Furnham, 2001; Petrides, Pita, & Kokkinaki, 2007; Siegling, Saklofske, Vesely, & Nordstokke, 2012; Smith, Ciarrochi, & Heaven, 2008). The self-report items, factor structure, item content, and response choices have overlapping content and structure with commonly used, standardized personality tests. For example, many of the factors in the Bar-On measure of emotional intelligence are closely related to personality traits measured by the 16 Personality Factor Questionnaire (16PF 5th edition; Cattell, Cattell, & Cattell, 1999), the Occupational Personality Scale (Furnam, Race, & Rosen, 2014), and the NEO Personality Inventory (PI)-3 (McCrae, 2000). As a result, the content and factor structure of theories and tests of emotional and social intelligence are likely a mixed model of noncognitive functioning that overlaps with personality traits.

Regardless of the criticism and debate over the constructs of emotional and social intelligence versus theories of personality, anecdotal discussion the authors of this study had with USAF ATC leadership reveal a consensus between training and career field managers, that candidates who successfully adapt to training are perceived to have higher levels of assertiveness, self-regard, emotional self-awareness, and independence, as well as adaptability, stress tolerance, and positive mood, whether considered a personality trait or form of emotional/social intelligence (Bar-On, 2004). However, the assessment of noncognitive functioning is not accounted for in current USAF screening processes.

Purpose of Study

The purpose of this exploratory study is to evaluate pretraining, standardized noncognitive aptitude testing (in conjunction with cognitive testing) from USAF air traffic control candidates in order to identify (a) cognitive and noncognitive areas of functioning that distinguish those who pass versus fail training, as well as (b) the incremental validity of noncognitive aptitude testing. On the basis of the studies cited in the previous sections, we hypothesized graduates would have higher levels of intrapersonal and interpersonal functioning, adaptability, stress management, and general mood and the collective combination of cognitive and noncognitive areas of functioning would improve the predictive validity of selection process.

Method

Participants

Data were collected from 1,003 training candidates (n = 808, 80.6% male; n = 195, 19.4% female) over the course of 2 years. Mean age for male and female participants was 20.84 (SD = 2.63) years and 20.77 (SD = 2.24) years, respectively. Race and ethnicity were not assessed. A total of 512 (51.0%) completed all training requirements and graduated, and a total of 491 (49.0%) did not graduate.

Measures

Armed Services Vocational Aptitude Battery (ASVAB)

The ASVAB (DMDC, 2008) was used to assess cognitive aptitude. Four composite scores are based on weighted combinations of seven subtests (see Table 1 for descriptions). The ASVAB composite scores have good reliability, correlate with academic achievement, and are predictive of subsequent military performance (Campbell & Knapp, 2001; Welsh, Kucinkas, & Curran, 1990). Composite scores reflect the respondent's percentile scores relative to the normative population, whereas subtest scores are standardized with a mean score of 50 and a standard deviation (SD) of 10.

Emotional Quotient Inventory (EQ-i)

The EQ-i (Bar-On, 2004) was used to assess noncognitive areas of functioning. The test was chosen because the constructs of the test appear to measure areas of noncognitive functioning relevant to ATC training. The test is composed of 133 items that load onto five major domain scales and 15 subscales (see Table 2 for descriptions). Items are rated on a 5-point Likert scale ranging from *very seldom true or not true of me* to *very often true of me or true of me*. Scale scores are normed for the general population, with a standardized mean score of 100 and SD of 15. Internal consistency estimates for the EQ-i subtests are > .76, with test–retest reliability estimates of .85 after 1 month and .75 after 4 months (Bar-On, 1997, 2000). The reliability estimate for this sample was .94.

Training Outcome

Training outcome was measured as a binary variable and candidates were identified as either graduates or nongraduates. Participants who voluntarily dropped out of training (i.e., "self-eliminated") and/or were not allowed to proceed further owing to insufficient performance were categorized in the nongraduate group. Participants who were removed from training for medical reasons were not included in this

Table 1. Composite scale and subtest descriptions of the ASVAB

Subtests/composite scales	Descriptions
Subtests	
General Science	Knowledge of physical and biological sciences
Arithmetic Reasoning	Ability to solve arithmetic word problems
Mathematical Knowledge	Knowledge of high school mathematics principles
Electronics Information	Knowledge of electricity and electrons
Mechanical Comprehension	Knowledge of mechanical and physical principles
Verbal Expression	Ability to select the correct meaning of words presented in a context, to identify the best synonym for a given word, and to obtain information from written passages
Auto and Shop Information	Knowledge of automobile technology and shop terminology and practices
Composite Scales	
General	Combination of Verbal Expression and Arithmetic Reasoning
Mechanical	Combination of Mechanical Comprehension, General Science, and Auto & Shop Information
Electrical	Combination of Arithmetic Reasoning, Mathematical Knowledge, Electronics Information, and General Science
Administrative	Verbal Expression

Note. ASVAB = Armed Service Vocational Assessment Battery.

Table 2. Subscale descriptions of the EQ-i

Domains/subscales	Subscale descriptions
Intrapersonal	
Emotional Self-Awareness	The ability to recognize one's feelings and emotions
Assertiveness	The ability to express feelings, beliefs, and thoughts and to defend one's right in a nondestructive manner
Self-Regard	The ability to respect and accept oneself as basically good
Self-Actualization	The ability to realize and strive to achieve one's potential capacities
Independence	The ability to be self-directed and self-controlled in one's thinking and actions and to be free of emotional dependency
Interpersonal	
Empathy	The ability to be aware of, to understand, and to appreciate the feelings of others
Interpersonal Relationship	The ability to establish and maintain mutually satisfying relationships that are characterized by intimacy and by giving and receiving affection
Social Responsibility	The ability to demonstrate oneself as a cooperative, contributing, and constructive member of one's social group
Adaptability	
Problem Solving	The ability to identify and define problems as well as to generate and implement potentially effective solutions
Reality Testing	The ability to assess the correspondence between what is experienced and what objectively exists
Flexibility	The ability to adjust one's emotions, thoughts, and behavior to changing situations and conditions
Stress Management	
Stress Tolerance	The ability to withstand adverse events and stressful situations without "falling apart" by actively and positively coping with stress
Impulse Control	The ability to resist or delay an impulse, drive, or temptation to act
General Mood	
Happiness	The ability to feel satisfied with one's life, to enjoy oneself and others, and to have fun
Optimism	The ability to look at the brighter side of life and to maintain a positive attitude, even in the face of adversity
Validity Scale	
Positive Impression	The tendency to present oneself in an overly favorable or unrealistically positive manner
Inconsistency	The tendency to respond to items in an inconsistent, random, or unreliable manner

Note. EQ-i = Emotional Quotient Inventory.

study. However, only a small portion (less than 6%) fail to complete training due to medical issues (Manacapilli et al., 2012).

Procedures

ASVAB testing was completed prior to the start of basic military training as a routine part of USAF entrance screening processes. The EQ-i was administered to candidates upon enlistment in the USAF and prior to entering ATC training. Candidates were informed that the test would not be used in the selection process. Upon completion of the EQ-i, participants' tests were scored and matched with their ASVAB scores. Subsequent training outcomes (graduate vs. nongraduate) were then merged with testing scores. The final database was then de-identified for the purposes of data analyses.

Data Analysis

The focus of this study was to determine the incremental validity of a noncognitive measure as value added when used in addition to cognitive measures in assessing outcomes of ATC trainees from the course of initial entry into training. All statistical analyses were performed using SAS® software, Version 9.3. This study focused on overall graduation rates from both the course of initial entry and the upgrade certification training. While the graduation rate from the course of initial entry was 77% (734/1,003), the overall graduation rate after upgrade certification training was 51% (512/1,003). This is crucial in that only those trainees who successfully completed upgrade certification training in either tower or radar controlling actually become operational.

Range restriction procedures were considered for both measures. Since there are minimum ASVAB score requirements to enter ATC training, the ASVAB scores were range restricted. Multivariate range restriction correlation adjustments were calculated (Lawley, 1943), and subsequent logistic regression analyses were conducted on uncorrected correlations (see Table 3). However, range restriction with noncognitive aptitude testing is less clear. Since such testing was not used for selection and there are no minimum or maximum requirements for test scores, direct range restriction did not appear to apply to such a measure. While indirect range restriction is possible with the correlated EQ-i and ASVAB measures, correlations are small to moderate, and therefore corrections for range restriction were not performed for the EQ-i.

Group means and standard deviations for all ASVAB and EQ-i variables used in the study are presented in Table 3. Hierarchal logistic regression was utilized to assess the impact of noncognitive aptitude testing scores on the ability to predict pass/fail training outcomes. All cognitive and noncognitive aptitude subtests were considered regardless of their individual impact on prediction. Using the standard threshold of 10 records per predictor (Hosmer & Lemeshow, 2000), all 22 potential predictors were considered for inclusion in the model. Initial logistic regressions were run for ASVAB only, EQ-i only, and combined models (see Table 4). This was followed by hierarchal stepwise regressions to limit the model to only those variables that demonstrated specific predictive validity (see Table 4). ASVAB composites and EQ-i domain scores are linear combinations of subtest scores, therefore they were not used in model building in combination with subtest scores. Goodness of fit for each model was determined by the increase in R^2 values as a result of including scores from the EQ-i, as well as the results of receiver operating characteristic (ROC), Hosmer–Lemeshow, and Akaike information criterion (AIC) analyses. Further, standardized beta estimates were used to establish the potential impact of each variables contribution to the model.

Results

Between-groups *t* tests were performed on both the Positive Impression Scale and Inconsistency Index. There were no differences between groups on the Positive Impression scale t (1,002) = −0.21, p = .83, which suggests that graduates' higher scores on the EQ-i were not due to a greater tendency to present themselves in a more favorable positive manner. Nongraduates did score higher on the Inconsistency Index, t (1,002) = 2.74, p = .01, suggesting they may have been slightly less careful or reliable in responding. However, mean scores on the Inconsistency Index (M = 4.46 for nongraduates, M = 3.99 for graduates) were well below 12, the recommended threshold for the test to be considered invalid.

In the first step of logistic regression procedures, all ASVAB subtest scores were entered. The resulting model was statistically significant and accounted for approximately 8.3% of training outcomes, Wald χ^2 (7) = 58.49, $p < .001$, $R^2 = 0.083$. The Hosmer–Lemeshow statistic was .07 suggesting the model may not be a good fit, with ROC = .64 and AIC = 1,325.98. In the second step, all 15 EQ-i subscale scores were assessed, which yielded a statistically significant model that accounted for approximately 8.7% of training outcomes, Wald χ^2 (15) = 60.28, $p < .001$, $R^2 = .087$. The Hosmer–Lemeshow statistic was .52 suggesting the model may be a good fit, with ROC = .65 and AIC = 1,322.69, both suggesting a moderate fit. When both ASVAB and EQ-i predictors were combined into one compensatory model, the model remained significant, Wald χ^2 (9) = 106.25, $p < .001$, $R^2 = .16$). The Hosmer–Lemeshow statistic was .94 suggesting the model may be the best fit, with ROC = .70 and AIC = 1262.50. The reduction in AIC to 1,262.50 suggests that the combined model is a better fit than either of the instruments alone (see Table 4).

The second step was to perform hierarchal stepwise regression to potentially identify the specific predictors of

Table 3. ASVAB and EQ-i descriptive statistics and correlations with graduate/nongraduate outcomes (N = 1,003)

Subtest and composite scales	Nongraduate	Graduate		
ASVAB Subtests	*M (SD)*	*M (SD)*	*r*	*rc*
General Science	56.34 (5.95)	57.71 (5.90)	.12**	.34
Arithmetic Reasoning	57.63 (5.56)	59.59 (5.28)	.18**	.38
Mathematical Knowledge	57.47 (5.54)	59.61 (4.99)	.20**	.40
Electronics Information	55.57 (6.79)	56.94 (7.18)	.10**	.29
Mechanical Comprehension	57.96 (6.39)	59.40 (6.38)	.11**	.32
Verbal Expression	56.69 (4.67)	57.43 (4.56)	.08**	.27
Auto and Shop Information	51.40 (6.96)	53.36 (7.56)	.13**	.24
ASVAB Composites				
General	76.26 (12.47)	80.43 (11.63)		
Mechanical	73.76 (13.18)	78.81 (12.99)		
Electrical	76.21 (13.33)	81.46 (11.97)		
Administrative	75.28 (12.93)	80.13 (11.81)		
EQ-i Composites and Subscales				
Intrapersonal	102.48 (14.60)	107.38 (13.15)		
Emotional Self-Awareness	104.26 (13.91)	107.02 (12.92)	.10**	
Assertiveness	104.45 (14.54)	108.84 (13.97)	.15**	
Self-Regard	103.04 (13.72)	107.31 (11.71)	.17**	
Self-Actualization	100.75 (14.59)	104.55 (12.92)	.14**	
Independence	97.17 (15.16)	101.88 (13.48)	.16**	
Interpersonal	102.41 (14.65)	105.13 (13.62)		
Empathy	101.66 (14.89)	103.65 (15.34)	.07*	
Interpersonal Relationship	102.83 (14.51)	105.61 (13.74)	.10**	
Social Responsibility	101.07 (14.27)	103.36 (13.28)	.08**	
Adaptability	101.60 (14.28)	108.43 (13.19)		
Problem Solving	100.02 (14.25)	102.86 (13.44)	.10**	
Reality Testing	99.67 (15.04)	105.40 (13.76)	.20**	
Flexibility	104.42 (15.19)	109.19 (13.29)	.17**	
Stress Management	102.57 (15.03)	106.96 (13.63)		
Stress Tolerance	104.64 (15.20)	111.24 (13.20)	.23**	
Impulse Control	99.82 (14.61)	103.48 (13.84)	.13**	
General Mood	103.07 (14.16)	108.12 (12.01)		
Happiness	104.58 (13.39)	108.55 (11.22)	.16**	
Optimism	101.50 (15.13)	106.85 (12.97)	.19**	
Validity Index				
Positive Impression	110.07 (15.01)	110.27 (15.09)		
Inconsistency Index	4.46 (2.71)	3.99 (2.72)		

Notes. Column headings indicate observed correlations (r) and correlations corrected for range restriction (r_c). Statistical significance was tested only for the observed correlations. ASVAB = Armed Service Vocational Assessment Battery. EQ-i = Emotional Quotient Inventory. *$p < .05$. **$p < .01$.

training success (see the variables in italics in Table 4). The resulting model was statistically significant and accounted for approximately 16% of training outcomes, Wald χ^2 (9) = 124.30, $p < .001$, $R^2 = .16$, ROC = .70, and the Hosmer–Lemeshow (Hosmer & Lemeshow, 2000) probability of .95, suggests a good model fit. In addition, the AIC statistic was minimal, as for the full model AIC = 1,265.71. Although the model does not meet all criteria at the highest level, it is identified as a good fit to the data.

Table 5 presents cross-validation results. The established leave-one-out cross-validation classification method is a procedure whereby, in these data, each trainee is classified based on the model developed from all other trainees over 1,003 iterations. The guideline is that the overall one-out cross-validation results should be within 10% of the original classification, which is the case in this study. While the leave-one-out method is widely accepted, it is not without its limitations. Therefore, it is recommended that a *k*-fold cross-validation be performed whereby 10–30 random test samples are created and classified based upon the trained model of the remaining data (Ounpraseuth, Lensing, Spencer, & Kodell, 2012). The result of the average *k*-fold = 10 classification is reported in Table 5. The classification cut-off criteria was set at .40. This cut-off was considered the appropriate criterion to minimize false-negative and false-positive error rates while maximizing correct classification rates. Current screening procedures result in approximately five out of 10 candidates graduating, while

Table 4. ASVAB and EQ-i logistic regression model predicting ATC training outcome (graduate vs. nongraduate)

Predictor	Wald χ^2	p	STB	MODEL STB*
ASVAB Subtests				
General Science	0.19	0.66	2.0	
*Arithmetic Reasoning**	*1.92*	*0.17*	*6.6*	*7.0*
*Mathematical Knowledge**	*16.68*	*<.0001*	*19.7*	*19.2*
Electronics Information	0.24	0.62	2.4	
Mechanical Comprehension	0.59	0.44	3.4	
Verbal Expression	0.57	0.45	3.2	
*Auto and Shop Information**	*13.71*	*0.00*	*17.4*	*16.0*
EQ-i Subscales				
*Emotional Self-Awareness**	0.59	0.44	*4.6*	*7.4*
Assertiveness	0.03	0.86	1.0	
Self-Regard	0.01	0.92	0.7	
*Self-Actualization**	*1.02*	*0.31*	*6.4*	*6.7*
Independence	0.36	0.55	3.1	
Empathy	0.03	0.86	1.2	
Interpersonal Relationship	0.74	0.39	6.5	
Social Responsibility	0.06	0.81	1.2	
*Problem Solving**	*2.58*	*0.11*	*8.4*	*6.5*
*Reality Testing**	*4.34*	*0.04*	*14.0*	*18.5*
Flexibility	0.13	0.72	2.1	
*Stress Tolerance**	*6.51*	*0.01*	*17.8*	*19.2*
Impulse Control	0.73	0.39	4.3	
*Happiness**	*2.02*	*0.16*	*10.1*	*11.0*
Optimism	1.20	0.27	8.1	

Note. Significant predictors included in the combined model are indicated with an asterisk and are in italicized font. ASVAB = Armed Service Vocational Assessment Battery. EQ-i = Emotional Quotient Inventory.

Table 5. Leave-one-out cross-validation classification of observed outcomes compared with predicted outcomes for the Combined Model

Predictions using both ASVAB and EQ-i with .40 cut-off criteria			
	Passed	Failed	Total
Predicted to Pass	436 Sensitivity 85% Of those who passed you are correct 85 out of 100 times	193 False positive 51% Of those who failed you are wrong 51 out of 100 times	629
Predicted to Fail	76 False negative 26% Of those who passed you are wrong 26 out of 100 times	298 Specificity 61% Of those who failed you are correct 61 out of 100 times	374
Current total	512 (51%)	491 (49%)	1,003

Notes. ASVAB = Armed Service Vocational Assessment Battery. EQ-i = Emotional Quotient Inventory.

the proposed model predicts seven out of 10 candidates graduating (i.e., 20% improvement in production).

Discussion

The current exploratory study sought to determine whether the assessment of noncognitive areas of functioning among ATC candidates prior to the start of training predicts subsequent graduation. Results were consistent with our hypothesis that graduates would (a) have higher levels of intrapersonal and interpersonal functioning, adaptability, stress management, and general mood and that (b) the inclusion of noncognitive aptitude testing with cognitive testing would improve prediction of training outcomes.

ATC graduates scored significantly higher on all ASVAB subtests. However, based on the results from the logistic regression, three ASVAB subtests (i.e., Mathematical Knowledge, Arithmetic Reasoning, and Auto and Shop

Information) significantly predicted graduation outcomes. These findings suggest that, in terms of cognitive aptitude, greater knowledge of high-school-level mathematic principles and increased familiarity with mechanical technology and practices may be especially important for success in the ATC career field. These findings align with those from an earlier study by Carretta and King (2008), who also found the ASVAB to be a strong predictor of training outcomes. The findings are also consistent with previous research by McBride (2012), who found that successful graduation from the US Marine Corps' ATC training program was predicted by performance on the ASVAB composite scales of Mathematical Knowledge and Auto and Shop Information subtests. Mathematical aptitude, along with other cognitive abilities, has similarly been identified as a significant predictor of successful task performance among civilian ATC personnel (Ackerman & Kanfer, 1993). As a result, these three ASVAB subtests appear to be important areas of functioning that are relevant to ATC career field training outcomes. Mathematics, for example, is an essential skill set for ATC personnel, who are required to calculate and consider factors such as velocity, distance, altitude, and spatial relationships when directing aircraft. Regardless of the highly computerized and automated processes that are available to assist controllers, mathematical aptitude continues to remain a significant predictor.

In terms of noncognitive functioning, ATC graduates had higher mean scores on all EQ-i composites and scales indicating higher levels of noncognitive functioning across the domains of interpersonal and intrapersonal functioning, stress management, adaptability, and general mood. Comparable findings for the 16PF have been reported among nonmilitary ATC personnel (Karson & O'Dell, 1974). The results of this study also suggest that the inner drive to objectively validate one's internal experiences with external reality (i.e., reality testing) and to effectively and constructively recognize and manage one's emotions (i.e., emotional self-awareness) as well as to remain emotionally calm and sustain a positive emotional demeanor (i.e., stress tolerance and happiness) under demanding conditions are especially important characteristics of successful ATC candidates. This finding converges with previous findings that civil ATC personnel report greater emotional stability than the general population (Luuk et al., 2009).

The relative contribution of emotional self-awareness, self-actualization, reality testing, stress tolerance, happiness, and approach to problem solving in the prediction of ATC graduation relative to the other areas of noncognitive aptitude may be due to their mutual relationship. For example, the ability to recognize, self-monitor, and regulate a positive inner emotional state of functioning refers to the amount of attention an individual directs toward his or her internal states and behaviors, and the extent to which these behaviors align with one's goals (Kanfer & Ackerman, 1989). ATC candidates who possess the ability to accurately judge their internal states and behaviors with respect to external objective indicators of performance and to actively respond to stress and difficult conditions in an effective manner (i.e., problem solving) may experience greater self-efficacy, which has been found to be correlated with performance among ATC personnel (Ackerman & Kanfer, 1993). Greater reality testing, stress tolerance, happiness, and an inner drive to achieve one's fullest potential (i.e., self-actualization) may also contribute to better training outcomes because ATC candidates with higher levels of these characteristics may perceive they have the ability to competently manage and effectively influence and/or control situations (i.e., problem solving). However, additional research is needed to determine how such areas of functioning fully influence job performance and interact over time. Regardless, the results of the study suggest that the inclusion of noncognitive functioning has added value to current screening procedures aimed at reducing training attrition.

There are both similarities and differences in training and job demands between USAF and civilian FAA air traffic control training (Air Force Enlisted Classification Directory, 2013; FAA, 2013; US Department of Labor, 2014). Both agencies have a tiered process that begins with classroom and simulation training where candidates are taught using lecture, computer-based instruction, and simulation with a range of fidelity and events that progressively mimic on-the-job knowledge and skill requirements. This initial phase lays the foundation of common, fundamental air traffic control procedures. The next tier of training moves to on-the-job training within an operational facility where trainees work with live traffic and are provided with close oversight and supervision. However, while in training, USAF ATC trainees must also complete professional military education, duties, and events outside of their career field that are part of their USAF enlistment requirements. These are not requirements among nonmilitary ATC training candidates. As a result, USAF ATC candidates may have additional occupational stressors that increase the rigors of training. Although there are similarities, there are likely enough differences between civilian and military programs that caution is recommended when generalizing the findings of this study.

Study Limitations

Conclusions based on the current study should be made cautiously owing to certain limitations. The current study utilized a self-report methodology, which could be vulnerable to response bias, especially within the context of personnel selection. This limitation may account for the fact that in the current sample, scores on the Positive Impression Index of the EQi were approximately one standard deviation above the normative mean, suggesting a tendency for participants to present themselves in a desirable manner. Additional studies should be conducted to determine the impact of response bias on the predictive validity of self-report measures prior to widespread inclusion of noncognitive aptitude testing among screening and selection procedures. Furthermore, evaluating the contribution of two instruments on training outcomes using a combined model that accounts for range restriction in one instrument (ASVAB, cognitive ability test) and not the other (EQ-I, noncognitive aptitude test) may give a biased impression of the importance of one set of predictors in relation to the other. In this case, it is perceived the statistical model

may result in biased interpretations of the uncorrected range-restricted predictors as having more or perhaps less importance than the unrestricted predictors. The authors recognize this concern and acknowledge that there may be a certain unintended bias in predictor interpretation and recommend further study is needed to address these issues. Another limitation is related to the characteristics of the sample, which was composed of military personnel from a single branch of service. The USAF population at large is an aggregate of many subgroups and therefore results among subgroups cannot be generalized to one another easily. It is also possible that study results do not generalize to other ATC samples. However, the fact that USAF ATC candidates must pass all FAA requirements for certification and graduation lends some confidence to the external validity of these findings. Despite these limitations, the current study provides information about areas of noncognitive functioning that may contribute to training success.

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References

Ackerman, P. L., & Kanfer, R. (1993). Integrating laboratory and field study for improving selection: Development of a battery for predicting air traffic controller success. *Journal of Applied Psychology, 78*, 413–432. doi: 10.1037/0021-9010.78.3.413

Air Force Enlisted Classification Directory. (2013, October). *Official guide to the Air Force Enlisted Classification Codes*. United States Air Force: Headquarters, Air Force Personnel Center. Retrieved from http://www.132fw.ang.af.mil/shared/media/document/AFD-130822-028.pdf

Austin, E. J. (2009). A reaction time study of responses to trait and ability emotional intelligence test items. *Personality and Individual Differences, 46*, 381–383. doi: 10.1016/j.paid.2008.10.025

Bar-On, R. (1997). *Bar-On Emotional Quotient Inventory: Technical manual (EQ-i)*. Toronto, Canada: Multi-Health Systems.

Bar-On, R. (2000). Emotional and social intelligence: Insights from the Emotional Quotient Inventory (EQ-i). In R. Bar-On & J. D. Parker (Eds.), *Handbook of emotional intelligence* (pp. 363–388). San Francisco, CA: Jossey-Bass.

Bar-On, R. (2004). The Bar-On Emotional Quotient Inventory (EQ-i): Rationale, description, and psychometric properties. In G. Geher (Ed.), *Measuring emotional intelligence: Common ground and controversy* (pp. 115–145). Hauppauge, NY: Nova Science Publishers.

Barrick, M. R. (2005). Yes, personality matters: Moving on to more important matters. *Human Performance, 18*, 359–372. doi: 10.1207/s15327043hup1804_3

Barrick, M. R., Mount, M. K., & Judge, T. A. (2001). Personality and performance at the beginning of the new millennium: What do we know and where do we go next? *International Journal of Selection and Assessment, 9*, 9–30. doi: 10.1111/1468-2389.00160

Burch, G. S. J., & Anderson, N. (2008). Personality as a predictor of work-related behavior and performance: Recent advances and directions for future research. In G. P. Hodgkinson & J. K. Ford (Eds.), *International review of industrial and organizational psychology* (23, pp. 261–305). Chichester, UK: John Wiley & Sons. doi: 10.1002/9780470773277

Campbell, J. P. & Knapp, D. T. (Eds.). (2001). *Exploring the limits in personnel selection and classification*. Hillsdale, NJ: Lawrence Erlbaum.

Carretta, T. R., & Frederick, M. S. (1999). Determinants of enlisted air traffic controller success. *Aviation, Space, and Environmental Medicine, 70*, 910–918.

Carretta, T. R., & King, R. E. (2008). *USAF enlisted air traffic controller selection: Examination of the predictive validity of the FAA air traffic selection and training battery versus training performance* (DOT/FAA/AM-08/9). Washington, DC: Federal Aviation Administration, Office of Aerospace Medicine.

Cattell, R. B., Cattell, A. K., & Cattell, H. E. (1999). *The 16PF* (5th Ed). St. Antonio, TX: Pearson.

Conzelmann, K., & Keye, D. (2014). "Which aspects of a semistructured interview, besides cognitive ability tests, contribute incrementally to predicting the training success of air traffic controller trainees?" *International Journal of Selection and Assessment, 22*, 240–252.

Cooper, A., & Petrides, K. V. (2010). A psychometric analysis of the Trait Emotional Intelligence Questionnaire-Short Form (TEIQue-SF) using item response theory. *Journal of Personality Assessment, 92*(5), 449–457. doi: 10.1080/00223891.2010.497426

Dawda, D., & Hart, S. (2000). Assessing emotional intelligence: Reliability and validity of the Bar-On Emotional Quotient Inventory (EQ-i) in university students. *Personality and Individual Differences, 28*(4), 797–812. doi: 10.1016/S0191-8869(99)00139-7

Day, A., & Carroll, S. (2008). Faking emotional intelligence (EI): Comparing response distortion on ability and trait-based EI measures. *Journal of Organizational Behavior, 29*, 761–784. doi: 10.1002/job.485

Day, A. L., Therrien, D. L., & Carroll, S. A. (2005). Predicting psychological health: Assessing the incremental validity of emotional intelligence beyond personality, type A behavior, and daily hassles. *European Journal of Personality, 19*(6), 519–536. doi: 10.1002/per.552

Day, D. V., & Silverman, S. B. (1989). Personality and job performance: Evidence of incremental validity. *Personnel Psychology, 42*, 25–36. doi: 10.1111/j.1744-6570.1989.tb01549.x

Dean, M. A., Russell, C. J., & Farmer, W. L. (2002). Noncognitive predictors of air traffic controller performance. In H. Eibfeldt, M. C. Heil, & D. Broach (Eds.), *Staffing the ATM system* (pp. 59–72). Burlington, VT: Ashgate.

Defense Manpower Data Center. (2008). *CAT-ASVAB forms 5–9* (ASVAB Technical Bulletin No. 3). Seaside, CA: Author.

Federal Aviation Administration. (2013). *A plan for the future: 10-year strategy for the Air Traffic Control Work Force, 2013-2022*. Washington DC: US Department of Transportation. Retrieved from http://www.faa.gov/air_traffic/publications/controller_staffing/media/CWP_2013.pdf

Fiori, M., & Antonakis, J. (2011). The ability model of emotional intelligence: Searching for valid measures. *Personality and Individual Differences, 50*, 329–334. doi: 10.1016/j.paid.2010.10.010

Furnam, A., Race, M. C., & Rosen, A. (2014). Emotional intelligence and the Occupational Personality Questionnaire.

Frontiers In Psychology, 5(935), 1–12. doi: 10.3389/fpsyg.2014.00935
Goleman, D. (1995). *Emotional intelligence*. New York, NY: Bantam Books.
Grubb, W. L., & McDaniel, M. A. (2007). The fakability of Bar-On's Emotional Quotient Inventory short form: Catch me if you can. *Human Performance, 20*, 43–59. doi: 10.1080/08959280709336928
Hosmer, D. W., & Lemeshow, S. (2000). *Applied logistic regression* (2nd ed.). New York: John Wiley & Sons.
Judge, T. A., & Ilies, R. (2002). Relationship of personality to performance motivation: A meta-analytic review. *Journal of Applied Psychology, 87*, 797–807. doi: 10.1037//0021-9010.87.4.797
Kanfer, R., & Ackerman, P. L. (1989). Motivation and cognitive abilities: An integrative/aptitude-treatment interaction approach to skill acquisition. *Journal of Applied Psychology, 74*, 657–690. doi: 10.1037/0021-9010.74.4.657
Karson, S., & O'Dell, J. W. (1971). Performance ratings and personality factors in radar controllers. *Journal of Clinical Psychology, 27*, 339–342. doi: 10.1002/1097-4679(197107)27:33.0.CO;2-S
Karson, S., & O'Dell, J. W. (1974). Personality makeup of the American air traffic controller. *Aerospace Medicine, 45*, 1001–1007.
King, R. E., Manning, C. A., & Dreschler, G. K. (2006). Operational use of the air traffic selection and training battery. *International Journal of Applied Aviation Studies, 6*, 207–217.
King, R. E., Retzlaff, P. D., Detwiler, C. A., Schroeder, D. J., & Broach, D. (2003). *Use of personality assessment measures in the selection of air traffic control specialists* (DOT/FAA/AM-03/20). Washington, DC: Federal Aviation Administration.
Kun, B., Urban, R., Paksi, B., Csobor, L. V., Olah, A., & Demetrovics, Z. (2012). Psychometric characteristics of the Emotional Quotient Inventory, youth version, short form, in Hungarian high school students. *Psychological Assessment, 24*, 518–523. doi: 10.1037/a0026013
Landy, F. J. (2005). Some historical and scientific issues related to research on emotional intelligence. *Journal of Organizational Behavior, 26*, 411–424. doi: 10.1002/job.317
Lawley, D. N. (1943). A note on Karl Pearson's selection formulae. *Proceedings of the Royal Society of Edinburg, Section A, 62*, 28–30. doi: 10.1017/S0080454100006385
Le, H., Oh, I. S., Robbins, S. B., Ilies, R., Holland, E., & Westrick, P. (2011). Too much of a good thing: Curvilinear relationships between personality traits and job performance. *Journal of Applied Psychology, 96*, 113–133. doi: 10.1037/a0021016
Lievens, F., Klehe, U.-C., & Libbrecht, N. (2011). Applicant versus employee scores on self-report emotional intelligence measures. *Journal of Personnel Psychology, 10*(2), 89–95. doi: 10.1027/1866-5888/a000036
Locke, E. A. (2005). Why emotional intelligence is an invalid concept. *Journal of Organizational Behavior, 26*(4), 425–431. doi: 10.1002/job.318
Luuk, K., Luuk, A., & Aluoja, A. (2009). Predicting professional success of air traffic control personnel from their personality profile at admission to ab initio training. *International Journal of Aviation Psychology, 19*, 235–251. doi: 10.1080/10508410902983896
Manacapilli, T., Matthies, C. F., Miller, L. W., Howe, P., Perez, P. J., Hardison, C. M., . . . Sims, C. S. (2012). *Reducing attrition in selected Air Force training pipelines* (Technical Report TR-955-AF). Santa Monica, CA: RAND Corporation.
Matthews, G., Zeidner, M., & Roberts, R. D. (2002). *Emotional intelligence: Science and myth*. Cambridge, MA: MIT Press.
Mayer, J., Salovey, P., & Caruso, D. (2004). Emotional intelligence: Theory, findings, and implications. *Psychological Inquiry, 15*(3), 197–215. doi: 10.1207/s15327965pli1503_02
McBride, T. (2012). *Study of personnel attrition and revocation within US Marine Corps air traffic control specialties*. (Master's thesis). Retrieved from https://calhoun.nps.edu/public/bitstream/handle/10945/6830/12Mar_McBride_Trey.pdf?sequence=1
McCrae, R. (2000). Emotional intelligence from the perspective of the Five-Factor Model of personality. In R. Bar-On & J. D. Parker (Eds.), *The handbook of emotional intelligence* (pp. 263–276). San Francisco, CA: Jossey-Bass.
Mikolajczak, M., Luminet, O., Leroy, C., & Roy, E. (2007). Psychometric properties of the Trait Emotional Intelligence Questionnaire. *Journal of Personality Assessment, 88*, 338–353. doi: 10.1080/00223890701333431
Mount, M. K., Barrick, M. R., & Stewart, G. L. (1998). Five-factor model of personality and performance in jobs involving interpersonal interactions. *Human Performance, 11*, 145–165. doi: 10.1080/08959285.1998.9668029
Newsome, S., Day, A. L., & Catano, V. M. (2000). Assessing the predictive validity of emotional intelligence. *Personality and Individual Differences, 29*(6), 1005–1016. doi: 10.1016/s0191-8869(99)00250-0
Nye, L. G., & Collins, W. E. (1991). *Some personality characteristics of air traffic control specialist trainees: Interactions of personality and aptitude test scores with FAA Academy success and career expectations* (DOT/FAA/AM-91/8). Washington, DC: Federal Aviation Administration, Office of Aviation Medicine.
Office of Personnel Management. (2014). *Classifications and qualifications: Air Traffic Control Series*. 2152. Retrieved from http:/www.opm.gov/policy-data-oversight/classification-qualifications/general-schedule-qualification-standards/2100/air-traffic-control-series-2152/
Ounpraseuth, S., Lensing, S. Y., Spencer, H. J., & Kodell, R. L. (2012). Estimating misclassification error: A closer look at cross-validation based methods. *BMC Research Notes, 5*, 656. doi: 10.1186/1756-0500-5-656
Pecena, Y., Keye, D., Conzelmann, K., Grasshoff, D., Maschke, P., Heintz, A., & Eiβfeldt, H. (2013). Predictive validity of a selection procedure for air traffic controller trainees. *Aviation Psychology and Applied Human Factors, 3*, 19–27. doi: 10.1027/2192-0923/a000039
Petrides, K. V., & Furnham, A. (2001). Trait emotional intelligence: Psychometric investigation with reference to established trait taxonomies. *European Journal of Personality, 15*, 425–448. doi: 10.1002/per.416
Petrides, K. V., Pita, R., & Kokkinaki, F. (2007). The location of trait emotional intelligence in personality factor space. *British Journal of Psychology, 98*, 273–289. doi: 10.1348/000712606X120618
Schmidt, F. L. (2002). The role of general cognitive ability and job performance: Why there cannot be a debate. *Human Performance, 15*, 187–210. doi: 10.1207/s15327043hup1501&02_12
Schmidt, F. L., & Hunter, J. E. (1998). The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 85 years of research findings. *Psychological Bulletin, 124*, 262–274. doi: 10.1037/0033-2909.124.2.262
Schmidt, F. L., & Hunter, J. (2004). General mental ability in the world of work: Occupational attainment and job performance. *Journal of Personality and Social Psychology, 86*, 162–173. doi: 10.1037/0022-3514.86.1.162
Schroeder, D. J., Broach, D., & Young, W. C. (1993). *Contribution of personality to the prediction of success in initial air traffic control specialist training* (DOT/FAA/AM-93/4).

Washington, DC: Federal Aviation Administration, Office of Aerospace Medicine.

Siegling, A. B., Saklofske, D. H., Vesely, A. K., & Nordstokke, D. W. (2012). Relations of emotional intelligence with gender-linked personality: Implications for a refinement of EI constructs. *Personality and Individual Differences, 52*, 776–781. doi: 10.1016/j.paid.2012.01.003

Slaski, M., & Cartwright, S. (2003). Emotional intelligence training and its implications for stress, health, and performance. *Stress & Health, 19*, 233–239. doi: 10.1002/smi.979

Smith, L., Ciarrochi, J., & Heaven, P. C. L. (2008). The stability and change of trait emotional intelligence, conflict communication patterns, and relationship satisfaction: A one-year longitudinal study. *Personality and Individual Differences, 45*, 738–743. doi: 10.1016/j.paid.2008.07.023

Tett, R. P., & Burnett, D. D. (2003). A personality trait-based interactionist model of job performance. *Journal of Applied Psychology, 88*, 500–517. doi: 10.1037/0021-9010.88.3.500

Tett, R. P., Jackson, D. N., Rothstein, M., & Reddon, J. R. (1999). Meta-analysis of bidirectional relations in personality–job performance research. *Human Performance, 12*, 1–29. doi: 10.1207/s15327043hup1201_1

Thoresen, C. J., Bradley, J. C., Bliese, P. D., & Thoresen, J. D. (2004). The big five personality traits and individual job performance growth trajectories in maintenance and transitional job stages. *Journal of Applied Psychology, 89*, 835–853. doi: 10.1037/0021-9010.89.5.835

US Air Force. (2006). *Air traffic control – 1C1X1*. Retrieved from http://www.af.mil/AboutUs/FactSheets/Display/tabid/224/Article/104595/air-traffic-control-1c1x1.aspx

US Air Force. (2013a). *Air Force enlisted classification directory: The official guide to the Air Force enlisted classification codes* [Restricted access]. Washington, DC: Department of the Air Force.

US Air Force. (2013b). Ground based aircraft controller medical standards. In *Medical examinations and standards* (Air Force Instruction 48-123). Washington, DC: Department of the Air Force. Retrieved from http://static.e-publishing.af.mil/production/1/af_sg/publication/afi48-123/afi48-123.pdf

United States Department of Labor. (2014). *Occupational outlook handbook: Air traffic controllers*. Bureau of Labor Statistics: Washington D.C. Retrieved from http://www.bls.gov/ooh/Transportation-and-Material-Moving/Air-traffic-controllers.htm#tab-4

Welsh, J. R., Kucinkas, S. K., & Curran, L. T. (1990). *Armed services vocational battery (ASVAB): Integrative review of validity studies* (AFHRL-TR-90–22). Brooks AFB, TX: Air Force Human Resources Laboratory.

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